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Euhrychiopsis lecontei (Dietz) as a Potential Biocontrol Agent of Eurasian Watermilfoil (*Myriophyllum spicatum* L.)

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Euhrychiopsis lecontei (Dietz) is a small native weevil that feeds on various species of watermilfoil. Its natural host is northern watermilfoil (*Myriophyllum sibiricum* Komarov); however, it has been shown to feed extensively on Eurasian watermilfoil (*Myriophyllum spicatum* L.). The ability of this insect to feed on and damage Eurasian watermilfoil has led to its use in the management of this non-indigenous plant.

Euhrychiopsis lecontei is a weevil in the family Curculionidae. It exhibits development in four distinct stages; egg, larva, pupa, and adult.

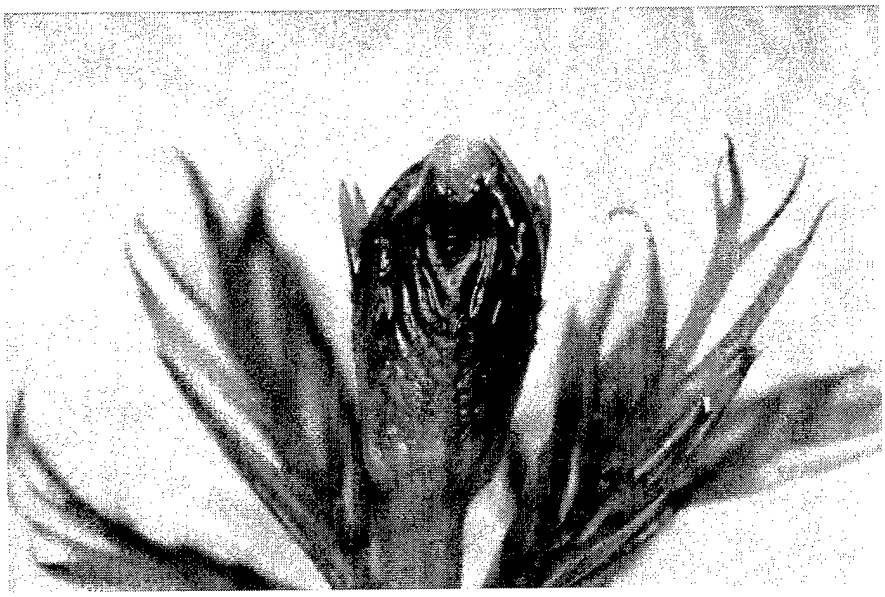

Photo 1. Weevil egg on the growing tip of Eurasian watermilfoil *(Ted Walker, Montpelier, VT)*

Egg

The female weevil usually lays its eggs individually in the apical portion of the stem near the water surface (Photo 1). Eggs are approximately 0.5 mm long, elliptical in shape, and have a creamy yellow color. At 20-25 °C, development time for the egg is 3-6 days (Sheldon and O'Bryan 1996a). Laboratory-reared eggs have been successfully hatched at rates between 65 and 100 percent (Sheldon and O'Bryan 1996a; Newman, Borman, and Castro 1997).

Larvae

After hatching, early instar larvae feed on plant meristematic tissue for 3-5 days (Creed and Sheldon 1994) and then migrate into the stem where they continue feeding (Photo 2). Larvae are found in the upper portion of the plant, generally within the top meter. Stems exhibiting larval feeding are less buoyant (Creed,

Sheldon, and Cheek 1992) and have a dark appearance where the stem has been hollowed out. Larval development takes 8-15 days at 20-25 °C (Sheldon and O'Bryan 1996a; Newman, Borman, and Castro 1997) with late instar larvae reaching a length of about 4.5 mm. Newman, Borman, and Castro (1997) recorded 78- to 90-percent survival through the larval stage.

Pupa

Late instar larvae create a pupal chamber inside the stem of the plant. These chambers are usually located in the thicker portions of the stem below the larval feeding damage. Pupal development (Photo 3) times have been reported between 9-12 days in water temperatures between 20-25 °C (Sheldon and O'Bryan 1996a; Newman, Borman, and Castro 1997). Pupal survival has been reported by Newman, Borman, and Castro (1997) to be 69-80 percent.

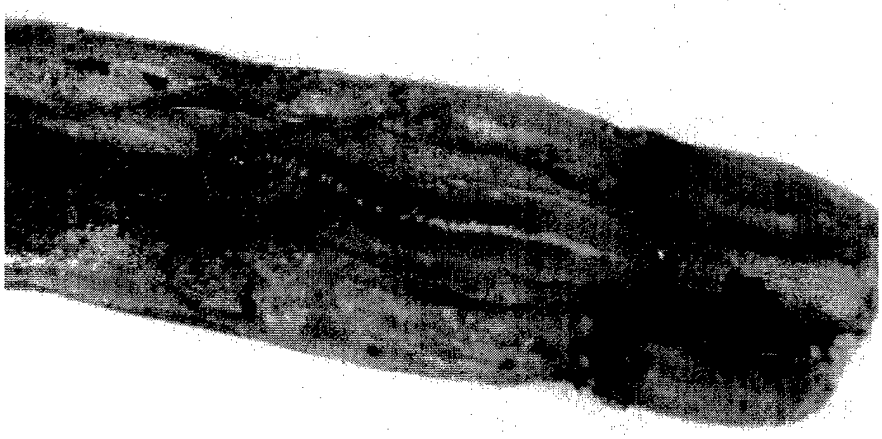

Photo 2. Weevil larva tunneling through Eurasian watermilfoil stem ***(Ted Walker, Montpelier, VT)***

Photo 3. Weevil pupa inside Eurasian watermilfoil stem ***(Ted Walker, Montpelier, VT)***

Adult

Adult weevils (Photo 4) are approximately 2-3 mm in length and have been reported by Sheldon and O'Bryan (1996a) to live as long as 162 days. Females lay an average of 1.9 eggs per day. Total egg production by captive females ranged up to 562 eggs (Creed and Sheldon 1994). Generally, adults are found in the upper 1 m of the plant. They feed on milfoil leaves and sometimes consume stem tissue. The complete life cycle from egg to adult takes from 23-27 days at 20-25 °C (Newman, Borman, and Castro 1997). Adults are weak swimmers and are the only life stage that can leave the water. In the fall they migrate to the shore and overwinter in organic matter (Creed and Sheldon 1994).

Weevil Rearing

The ability of *E. lecontei* to feed on Eurasian watermilfoil has made it useful to resource managers concerned with controlling this nonindigenous plant. *Euhrychiopsis lecontei* is easy to rear in aquaria or small containers. The procedures outlined below allow easy and rapid development of insect populations in a relatively small space.

- Keep the tank clean. Always *thoroughly* wash the tank before and between weevil additions. Do not use any chemical detergents, as they may leave a residue.
- Do not use chlorinated tap water to fill the tank. Lake water relatively free of suspended

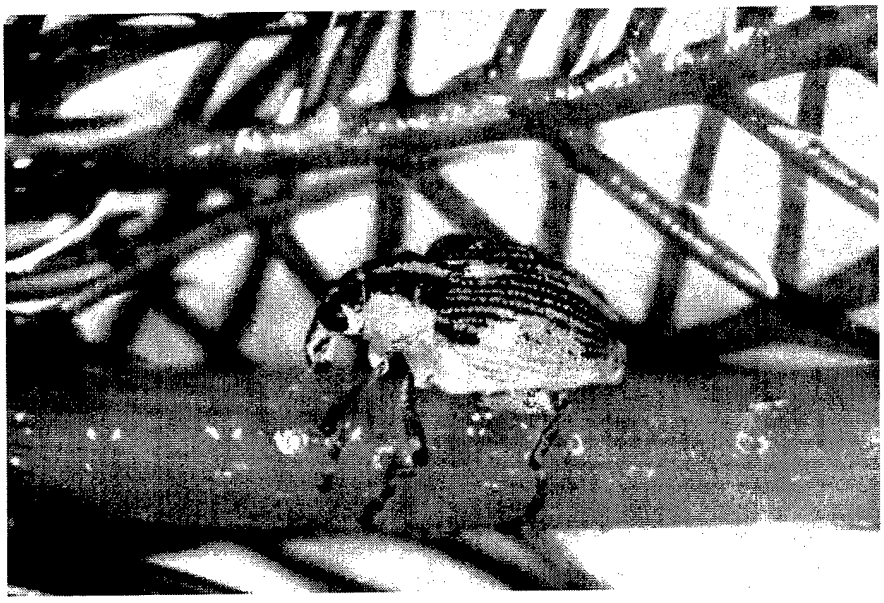

Photo 4. Adult weevil (*Euhrychiopsis lecontei*) on Eurasian watermilfoil stems *(Ted Walker, Montpelier, VT)*

sediment and debris is fine. Aerating the tank is a good idea, but is not absolutely essential. *Keep in mind that most air pumps are not designed for outdoor use. Get recommendations from the pump manufacturer or dealer before using this type of equipment outside.*

- Bright light, but not full sun, is best. Water temperature should remain between 20 and 25 °C. If located in full sun, cover the tank with a shade cloth or screen.
- Use good quality milfoil in the tank. Plants should be healthy, green, and free from insect or other damage on the stems and leaves. Do not use flowering plants, and if possible, remove any attached insects before adding weevils to the tank. About 50 milfoil stems will fill a 20-gal tank. Eurasian watermilfoil stems can be easily collected by hand and transported to the rearing area in a plastic tub partially filled with water. Group plant material into bundles of approximately 15 stems, 18-24 cm long, and secure with a rubber band (Photo 5). Attach the bundles to a small stone (5 cm sq) (Photo 6) and place the bundles in the tank so the apical portion of the stems is located approximately 0-10 cm below the water surface.
- Add the weevils to the tank as soon as they are collected or received. Do not touch the weevils directly, as this can stress them. Move them around on milfoil fragments instead. They are awkward swimmers and cling to milfoil very readily. Twenty weevils per tank is recommended. Adding fewer weevils is fine, but don't crowd the weevils by adding more than 30 adults per 20-gal tank.
- Once weevil adults have been introduced, observe the tank over the next 12 to 14 days to see weevils feeding, mating, and laying eggs. Observe damage to milfoil in the tank to become familiar with its appearance. This may help to identify weevil damage when it occurs in the field.
- After about 2 weeks, there should be enough eggs and larvae for a field introduction. Carefully remove milfoil stems with weevil eggs, larvae, and any remaining adults from the tank. Count and record the numbers of each life stage. A light

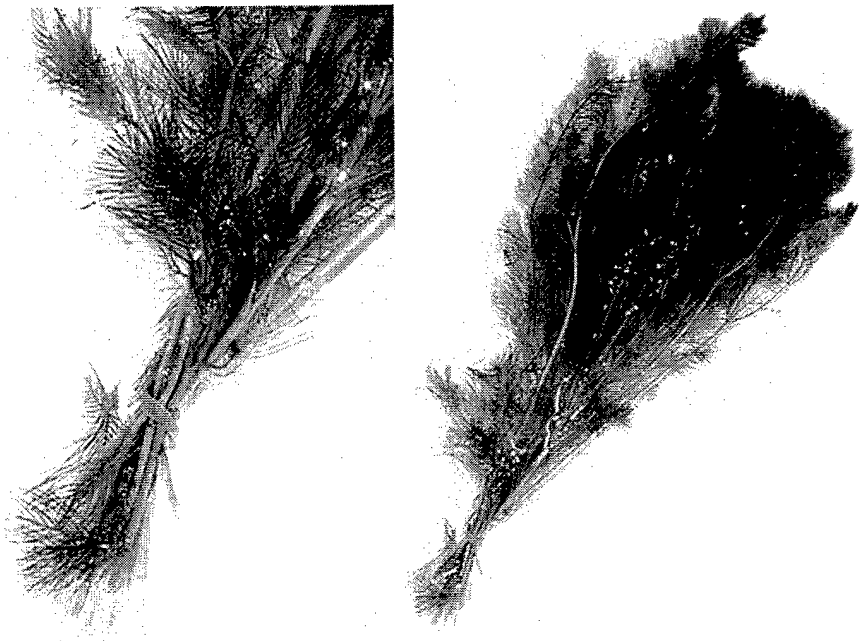

Photo 5. Bundles of Eurasian watermilfoil held together with rubber bands *(Lavon Jeffers, Vicksburg, MS)*

Photo 6. Rocks attached to bundles of Eurasian watermilfoil prior to being placed into tank ***(Lavon Jeffers, Vicksburg, MS)***

and magnifying glass may help with this task. Place the extracted weevils and milfoil in large zip-lock plastic bags filled with lake water for transport to the introduction site(s). Release the weevils the same day they are extracted from the tank. Research has shown that reproduction rates are lower when adult weevils are reused for rearing. It is best to use "fresh" weevils for a second round of rearing.

- Weevils should be introduced into the lake with care. Gently hand-tie milfoil fragments with weevils to the tops of existing milfoil plants in an area where there is dense growth. This can be done by snorkeling, or from a boat if the plants are close to the water surface. If snorkeling, be very careful not to disturb the milfoil plants with swim fins. The idea is to keep the fragments with weevils attached to the tops of milfoil in the release area, rather than having them sink to the lake bottom where they are less likely to survive. Choose an area away from heavy boat traffic.
- Keep accurate and detailed records of the number of eggs, larvae, and adults placed into the waterbody. Keep track of the location(s) of the introduction sites and the date(s) on which the introductions were made. All introductions should occur by the end of August, since weevils begin to leave the lake for their shoreline overwintering areas in September.
- There may be state laws that regulate weevil importation, introduction, and collection, so ensure that all parts of the law are complied with. Contact the state environmental agency for more information.
- For questions about rearing or introducing weevils, or about using the weevil for biological control of Eurasian watermilfoil, call Holly Crosson (802-241-3786) or Al Cofrancesco (601-634-3182).

Equipment

- 20-gal tank
- Screen or shading material
- Air pump (optional)
- Thermometer (optional, but useful to monitor tank temperature)
- Small stones (for weighting down milfoil stems)
- Rubber bands (for making milfoil bundles and attaching stones to milfoil stems)
- Large zip-lock bags (for transporting weevils during introductions)
- Five-gal bucket (for transporting bags of weevils)
- Magnifying glass (optional, but useful for observing and counting weevils in the tank)
- Small boat, mask, fins, snorkel, and wetsuit (all optional, but very useful for introductions)
- Notebook to record weevil rearing and introduction data

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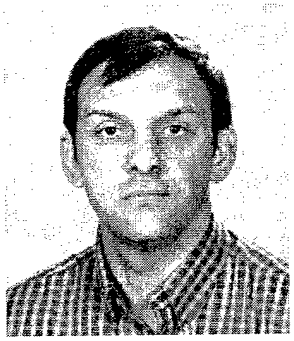

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